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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/321,611	05/28/99	QU	D 2925-0272P

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EXAMINER	
~~LAMARRE, G~~	
ART UNIT	PAPER NUMBER
2133	6

DATE MAILED: 10/02/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)
	09/321,611	QU, DONGHUI
	Examiner	Art Unit
	Guy J Lamarre, P.E.	2133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 May 1999 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-35 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-35 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 28 May 1999 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1- 35 are presented for examination.

Claim Rejections - 35 USC ' 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.1 **Claims 1-35** are rejected under 35 U.S.C. 103(a) as being unpatentable **Applicants' Admitted prior art** (hereinafter **Admitted prior art**).

As per Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35, Admitted prior art substantially discloses the procedure for the claimed computer-implementable means of performing modulo division, using a dividend N and an n-bit divisor D to produce a remainder R. {See **Admitted prior art,** page 1 line 7 – page 3 line 9, in passim, wherein apparatus and method are described.} **Not specifically described** in detail in **Admitted prior art** is the step of non-iteratively processing N mod D to produce the remainder R, wherein $D=2^n-1$ and $0<N<(D-1)^2$.

However such technique of non-recursively processing a division operation to find a remainder is well-known. One such approach is as follows: if one wishes to deduce whether a number X is an integer multiple of the number 2, one only needs to know whether said number X is odd or even. As a result, the remainder would be zero if X is even, and one if X is odd or a prime number

For example, what is the remainder of 3 div 2 or 3 mod 2? Since 3 is odd, then 3 mod 2 is 1, and no division operation is required, i.e., by inspection, one intuitively can deduce the answer by looking at 3. Therefore, if one chooses to restrict divisor values to 2 or 2^n, one can find

remainders by simple inspection of the digits or bits of dividends to determine whether dividends are odd or even.

Since computers deal with numbers in base 2, these numbers are either zeros or ones, i.e., odd or even. For example N1=1000 and N2=0011. Non-recursively, one can deduce that N1 mod (0010) is zero and N2 mod (0010) is one because N1 is even and N2 is odd. Therefore looking at the last bits of N1 and N2 or adding the last bits of N1 or N2 to bits of 2^n dictates the value of remainder that would ensue in dividing N1 or N2 into any number or divisor that is a multiple of the number 2, thereby obviating the need to perform the division operation.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the procedure in the **Admitted prior art** by including therein means to restrict divisor and dividend values to a suitable range as is well-known in computing, because such modification would provide the procedure disclosed in **Admitted prior art** with a technique wherein computation of remainders can be effected by simple inspection of the dividend digits.

As per Claims 4-6, 16-18, 29, 33, generally known is the procedure for the claimed computer- implementable method of claim 1, further comprising the step of subtracting the divisor D from the sum to produce the remainder R, if the sum is greater than the divisor D. For example N1=1000 and N2=0011. Non-recursively, one can deduce that N1 mod (0010) is zero and N2 mod (0010) is one because N1 is even and N2 is odd. Therefore looking at the last bits of N1 and N2 or adding the last bits of N1 or N2 to bits of 2^n dictates the value of remainder that would ensue in dividing N1 or N2 into any number or divisor that is a multiple of the number 2. Incidentally, that's how long hand division is performed, e.g., 9 mod 2 or 1001 mod (0010)=

2+2+2+2+1/2. Since 4 is more than 2 :subtract 2 from 4, etc., until we arrive at zero to therefore conclude that ½ is less than 2, hence remainder is 1, or 9 mod 2 or 1001 mod (0010) is one.

As per Claims 25-27, Admitted prior art discloses the procedure for the claimed apparatus of claims 14,..., wherein said apparatus is a component of a Reed Solomon coder. {See **Admitted prior art,** page 1 line 7 – page 3 line 9, in passim, wherein apparatus and method are described, e.g. Reed Solomon coders use finite field theory in their implementation (page 3 line 24).}

2.2 Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Applicants' Admitted prior art** (hereinafter **Admitted prior art**) in view of **Orton et al.** (New fault tolerant techniques for residue number systems; IEEE, page(s): 1453 – 1464; Nov. 1992)

As per Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35, Admitted prior art substantially discloses the procedure for the claimed computer-implementable means of performing modulo division, using a dividend N and an n-bit divisor D to produce a remainder R. {See **Admitted prior art,** page 1 line 7 – page 3 line 9, in passim, wherein apparatus and method are described.} **Not specifically described** in detail in **Admitted prior art** is the step of non-iteratively processing N mod D to produce the remainder R, wherein $D=2^n-1$ and $0<N<(D-1)^2$.

However such technique of non-recursively processing a division operation to find a remainder is well-known. One such approach is as follows: if one wishes to deduce whether a number X is an integer multiple of the number 2, one only needs to know whether said number X is odd or even. As a result, the remainder would be zero if X is even, and one if X is odd or a prime number

For example, what is the remainder of 3 div 2 or 3 mod 2? Since 3 is odd, then 3 mod 2 is 1, and no division operation is required, i.e., by inspection, one intuitively can deduce the answer

by looking at 3. Therefore, if one chooses to restrict divisor values to 2 or 2^n, one can find remainders by simple inspection of the digits or bits of dividends to determine whether dividends are odd or even.

Since computers deal with numbers in base 2, these numbers are either zeros or ones, i.e., odd or even. For example N1=1000 and N2=0011. Non-recursively, one can deduce that N1 mod (0010) is zero and N2 mod (0010) is one because N1 is even and N2 is odd. Therefore looking at the last bits of N1 and N2 or adding the last bits of N1 or N2 to bits of 2^n dictates the value of remainder that would ensue in dividing N1 or N2 into any number or divisor that is a multiple of the number 2, thereby obviating the need to perform the division operation.

As suggested, the closed formula or algorithmic approach of finding remainder is well-known, e.g., **Orton et al.**, in an analogous art, discloses residue number systems wherein such techniques are described. {See **Orton et al.**, Id., Abstract, and page 1454 col. 1 sect. II. – page 1460.}

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the procedure in the **Admitted prior art** by including therein means to restrict divisor and dividend values to a suitable range as is well-known in computing and as taught by **Orton et al**, because such modification would provide the procedure disclosed in **Admitted prior art** with a technique wherein '*multiplicand... stays the same provided the scaled range is sufficiently large for all planned combinations of moduli in a projection.*' {See **Orton et al.**, page 1463 para. 1.}

2.3 **Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Applicants' Admitted prior art** (hereinafter **Admitted prior art**) in view of **Stout** (Basic Electrical Measurements; 2d Ed., 1960; pages 82-85.)

As per Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35, Admitted prior art substantially discloses the procedure for the claimed computer-implementable means of performing modulo division, using a dividend N and an n-bit divisor D to produce a remainder R. {See **Admitted prior art,** page 1 line 7 – page 3 line 9, in passim, wherein apparatus and method are described.} **Not specifically described** in detail in **Admitted prior art** is the step of non-iteratively processing N mod D to produce the remainder R, wherein $D=2^n-1$ and $0<N<(D-1)^2$.

However such technique of non-recursively processing a division operation to find a remainder is well-known. One such approach is as follows: if one wishes to deduce whether a number X is an integer multiple of the number 2, one only needs to know whether said number X is odd or even. As a result, the remainder would be zero if X is even, and one if X is odd or a prime number

For example, what is the remainder of 3 div 2 or 3 mod 2? Since 3 is odd, then 3 mod 2 is 1, and no division operation is required, i.e., by inspection, one intuitively can deduce the answer by looking at 3. Therefore, if one chooses to restrict divisor values to 2 or 2^n, one can find remainders by simple inspection of the digits or bits of dividends to determine whether dividends are odd or even.

Since computers deal with numbers in base 2, these numbers are either zeros or ones, i.e., odd or even. For example N1=1000 and N2=0011. Non-recursively, one can deduce that N1 mod (0010) is zero and N2 mod (0010) is one because N1 is even and N2 is odd. Therefore looking at the last bits of N1 and N2 or adding the last bits of N1 or N2 to bits of 2^n dictates the value of remainder that would ensue in dividing N1 or N2 into any number or divisor that is a multiple of the number 2, thereby obviating the need to perform the division operation.

As suggested, the closed formula or algorithmic approach of finding remainder is well-known, e.g., **Stout,** in an analogous art, discloses means to divide two numbers by approximation wherein such techniques are described. {See **Stout,** Id., pages 82-85, especially longhand division on page 85.}**Therefore**, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the procedure in the **Admitted prior art** by including therein division approximation means based on a suitable range as is well-known in computing and as taught by **Stout,** because such modification would provide the procedure disclosed in **Admitted prior art** with a technique wherein means to estimate or approximate mathematical results such as remainders, quotients reduces to subtracting or adding divisor to quotients, etc. {See **Stout,** page 83, e.g., 10542/10311=(10311+231)/10311=1+231/10311=>remainder =231 ; or 0.9223/0.9535=1-...=>312.}

2.4 **Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Applicants' Admitted prior art** (hereinafter **Admitted prior art**) in view of **Saha, A et al.** (Design and FPGA implementation of efficient integer arithmetic algorithms; IEEE, page(s): 4 p; 4-7 April 1993)

As per Claims 1-3, 7-12, 13-14, 19-24, 28, 32, 34-35, Admitted prior art substantially discloses the procedure for the claimed computer-implementable means of performing modulo division, using a dividend N and an n-bit divisor D to produce a remainder R. {See **Admitted prior art,** page 1 line 7 – page 3 line 9, in passim, wherein apparatus and method are described.} **Not specifically described** in detail in **Admitted prior art** is the step of non-iteratively processing N mod D to produce the remainder R, wherein $D=2^n-1$ and $0<N<(D-1)^2$.

However such technique of non-recursively processing a division operation to find a remainder is well-known. One such approach is as follows: if one wishes to deduce whether a number X is an integer multiple of the number 2, one only needs to know whether said number X

is odd or even. As a result, the remainder would be zero if X is even, and one if X is odd or a prime number

For example, what is the remainder of 3 div 2 or 3 mod 2? Since 3 is odd, then 3 mod 2 is 1, and no division operation is required, i.e., by inspection, one intuitively can deduce the answer by looking at 3. Therefore, if one chooses to restrict divisor values to 2 or 2^n, one can find remainders by simple inspection of the digits or bits of dividends to determine whether dividends are odd or even.

Since computers deal with numbers in base 2, these numbers are either zeros or ones, i.e., odd or even. For example N1=1000 and N2=0011. Non-recursively, one can deduce that N1 mod (0010) is zero and N2 mod (0010) is one because N1 is even and N2 is odd. Therefore looking at the last bits of N1 and N2 or adding the last bits of N1 or N2 to bits of 2^n dictates the value of remainder that would ensue in dividing N1 or N2 into any number or divisor that is a multiple of the number 2, thereby obviating the need to perform the division operation.

As suggested, the closed formula or algorithmic approach of finding remainder is well-known, e.g., **Saha, A et al.,** in an analogous art, discloses division module wherein such remainder algorithms or techniques are described. {See **Saha, A et al.,** Id., Abstract, and pages 1-4 renumbered, especially page 2 col. 2 and page 4 :Evaluation of the mod function.}

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the procedure in the **Admitted prior art** by including therein means to restrict divisor and dividend values to a suitable range as is well-known in computing and as taught by **Saha, A et al,** because such modification would provide the procedure disclosed in **Admitted prior art** with a technique wherein 'predetermined and

constant values in division process enable simplicity of hardware implementation.' {See **Saha, A et al.**, page 4 algorithm last line, and conclusions.}

2.5 Examiner requests that Applicant provide information on any copending applications that may raise **double patenting** issues with instant application.

Claim Rejections - 35 USC § 112 first **Paragraph**

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3.1. **Claims 1-35** are rejected under 35 U.S.C. **§ 112** first **Paragraph** for failing to disclose procedure to force Divisor to always equal **2^n-1 or alternative means to implement should it be impossible to fix the value of N to make system operational.** It is apparent that if there is no doubt as to the value of the divisor, no computation recursive or iterative or otherwise for a remainder is required.

Specification

4. The disclosure is objected to because:

On page 3 lines 5 and 7, the characters 'n and N' are ambiguous.

On page 5, equations 5 and 7, separation of N as having two value ranges seems not to be correct, because negative and positive values of the same variables are being added on the right side of Equation 4, which should add up to zero. Hence it is doubtful that such cancelling effect would cause R and Q to restrict or bound the value of N in any way.

Appropriate correction or clarification is required.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The references are cited in Form PTO-892 for the Applicant's review and comments.

5.1 Any response to this action should be mailed to:

Commissioner of Patents and Trademarks, Washington, D.C. 20231

or faxed to:

(703) 308-9051, (for formal communications intended for entry)

Or:

(703) 305-9724 (for informal or draft communications, please label "PROPOSED" or "DRAFT")

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guy Lamarre whose telephone number is (703) 305-0755. The examiner can normally be reached on Monday to Friday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady, can be reached on (703) 305-9595.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

Guy Lamarre, P.E.

Patent Examiner

09/28/01

A. Decady

ALBERT DECADY
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